

Marshall Star, June 13, 2012 Edition

MARSHALL STAR

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Rocket Sled Tests Are Technology Pathway to Safely Land Humans, Habitats and Cargo on Mars

By Sanda Martel

Traveling 300 million miles through deep space to reach the planet Mars is difficult; successfully landing there is even harder. The process of entering the Red Planet's atmosphere and slowing down to land has been described as "six minutes of terror."

Image right: The Low-Density Supersonic Decelerator Project will test inflatable decelerators and advanced parachutes in a series of rocket sled, wind tunnel and rocket-powered flight tests to slow spacecraft prior to landing. This technology will allow NASA to increase landed payload masses, improve landing accuracy and increase the altitude of safe landing-sites. (NASA)

During the first four minutes of entry, friction with the atmosphere slows a spacecraft considerably. But at the end of this phase, the vehicle is still traveling at over 1,000 mph with only 100 seconds left before landing. Things need to happen in a hurry. A parachute opens

to slow the spacecraft down to "only" 200 mph, but now there are only seconds left and the spacecraft is approximately 300 feet from the ground. From there, the spacecraft may use rockets to provide a gentle landing on the surface, airbags to cushion the impact of a free fall or a combination of rockets and tethers to lower a rover to the surface.



Landing payloads that are large enough to bring humans and sustain their survival on the Red Planet is still beyond our capability. The same parachute design developed for the Viking missions in the 1970s has been used for all U.S. missions to the surface of Mars, including the Curiosity rover that will land in August of this year. To conduct advanced exploration missions in the future, however, NASA must advance deceleration technology to a new level of sophistication.

"We have now outgrown that capability and need to develop a larger parachute that will enable a larger payload," said Mark Adler, project manager for a new technology demonstration task at the Jet Propulsion Laboratory.

Enter the Low-Density Supersonic Decelerator Project, an ambitious technology development and demonstration effort the likes of which has not been attempted since before the Viking missions to Mars. The project will test inflatable decelerators and advanced parachutes in a series of rocket sled, wind tunnel and rocket-powered flight tests.

The Low-Density Supersonic Decelerator Project is managed by JPL for NASA's Office of the Chief Technologist. The mission is one of nine missions reporting to the Technology Demonstration Missions Program managed at the Marshall Space Flight Center.

The project includes three decelerators. Two are inflatable -- very large (20 feet and 26 feet in diameter, respectively), durable, balloon-like pressure vessels that inflate around the perimeter of the entry vehicle to enhance drag in the Martian atmosphere at supersonic speeds (greater than Mach 3.5) and slow the vehicle to Mach 2. The third device is a parachute measuring 110 feet in diameter that will further slow the entry vehicle from Mach 2, or nearly 1,100 mph, to less than 175 mph. All three devices will be the largest of their kind ever flown at such high supersonic speeds.

These kinds of devices are often tested in a wind tunnel prior to flight; however, the parachute is so large that it will not fit

inside any existing wind tunnel and the inflatable decelerators are too large for current supersonic wind tunnels. Thus, a series of rocket sled tests will begin early next year at the U.S. Naval Air Weapons Station at China Lake to replicate the high aerodynamic forces each of these structures would experience during entry and descent at Mars. One set of tests will accelerate an aeroshell 15 feet in diameter to 300 mph in just a few seconds using a rocket sled.

The inflatable decelerator will then be deployed to simulate the stresses it would see during flight. Another set of tests will attach a parachute to the rocket sled to verify that the parachute will be able to withstand the forces expected during supersonic flight. The technology development effort will culminate in a series of flight tests, in which an Apollo-sized capsule is lifted to an altitude of 120,000 feet -- to simulate the thin Martian atmosphere -- using a balloon, and accelerated to Mach 4 using a rocket. The decelerator systems are then tested almost exactly as they would be used at Mars, enabling future missions to confidently use these technologies to land there.

Together, these new decelerators can almost double the payload mass that we are able to land on Mars. Also, because they slow the spacecraft more quickly, they will increase altitudes at which payloads can be landed by 6,500-9,800 feet, increasing the accessible surface area we can explore to nearly three-quarters of the surface of Mars. They can also improve landing accuracy from more than 6 miles to just over 1.5 miles. All these factors will increase the capabilities and robustness of robotic and human explorers on Mars. The tests conducted by the Jet Propulsion Laboratory represent the first steps on the technology pathway to land humans, habitats and cargo safely on Mars. Rocket sled testing will continue through 2012, with a flight demonstration scheduled 18 months later to advance the technology to flight readiness level.

NASA continues to develop space technologies such as these to enable future deep space missions with exciting new capabilities for humans to explore and discover.

For more information on new space technology and innovations, visit the Office of Chief Technologist website <http://www.nasa.gov/offices/oct/home/index.html>.

Martel, an AI Signal Research Inc. employee, supports the Office of Strategic Analysis & Communications.

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Message from the Acting Center Director: Employee Viewpoint Survey



Gene Goldman (NASA/MSFC)

Civil Service employees,

By now you may have seen the email from Administrator Bolden as well as an email from OPM with a link to the Federal Employee Viewpoint Survey (FedView Survey). I am very invested in keeping MSFC (and NASA) one of the best places to work and your views are very important to me as well as your Center management team. If you received an invitation to participate, please take a few moments to complete the survey by following the link provided in the email. This annual survey provides federal employees with an opportunity to share their perspectives on a variety of workforce and work life matters and is used as the basis for determining the best (and worst) places to work in the federal government. In addition, your participation provides Agency and MSFC Management with valuable insight into the challenges we

face as leaders and the areas on which we need to focus to ensure we maintain an effective civilian workforce. Completing the survey should take no more than 35 minutes, and offers you the opportunity to express your thoughts and opinions regarding your job, agency, and the workforce as a whole. If you were selected to complete the survey, I encourage you to do so and help keep NASA one of the top Agencies in the country to work!

Gene

NASA Surpasses Test Facility Record with J-2X Powerpack Test

NASA news release

NASA's Stennis Space Center broke its own record June 8 when it conducted a record-setting test on J-2X powerpack. The test lasted for 1,150 seconds, surpassing the previous record by more than a full minute. The Marshall Space Flight Center manages the J-2X project as part of the Space Launch System Program Office.

Image right: During a record-breaking June 8 test, engineers at the Stennis Space Center throttled the J-2X powerpack up and down several times to explore numerous operating points required for the fuel and oxidizer turbopumps. The results of this test will be useful for determining performance and hardware life for the J-2X engine turbopumps. The test set a record for Stennis' A Test Complex for the longest duration test to date at 1,150 seconds. (NASA/SSC)



For NASA, the test marked a milestone step in development of a next-generation rocket engine to carry humans deeper into space than ever before. For Stennis, the 19-minute, 10-second test represented the longest duration firing ever conducted in the center's A Test Complex.

"This is the longest and the most complex J-2X test profile to date," said Mike Kynard, NASA's Space Launch System liquid engines element manager. "By combining as many test objectives as we can, we aim to get the most out of every opportunity and work as affordably and efficiently as possible while maintaining a reasonable level of risk."

The powerpack is a system of components on the top portion of the J-2X engine, including the gas generator, oxygen and fuel turbopumps, and related ducts and valves. As designed, the powerpack system feeds the thrust chamber system, which produces engine thrust. By removing the thrust chamber assembly, including the main combustion chamber, main injector and nozzle, engineers can push more easily the turbomachinery components over a wide range of conditions to demonstrate durability and safety margins.

"Setting a new record for the longest duration test on one of our stands in the A complex is a testament to the longevity and versatility of our testing facilities," said Randy Galloway, engineering and test director at Stennis. "These stands, originally built in the 1960s to test the stages for the Apollo Program, then used for the Space Shuttle Program, now are being used to test for the next generation vehicle that will take us farther than we have ever gone."

This record-breaking test explored numerous operating points required for the fuel and oxidizer turbopumps. The results of this test will be useful for determining performance and hardware life for the J-2X engine turbopumps. The test also allowed operators to calibrate flow meters on the stand, which measure the amount of liquid hydrogen and liquid oxygen delivered to the powerpack.

Before the powerpack test, the longest firing in Stennis' A Test Complex occurred in August 1989, with a 1,075-second test of a space shuttle main engine. The B Test Complex still claims the record for test duration at more than 2,000 seconds.

The J-2X engine is the first human-rated liquid oxygen and liquid hydrogen rocket engine to be developed in four decades. It will power the upper stage of NASA's evolved Space Launch System, an advanced heavy-lift rocket that will provide an entirely new national capability for human exploration beyond Earth's orbit.

Pratt & Whitney Rocketdyne is developing the J-2X engine for the Marshall Center.

The June 8 test is part of a second series of firings on the powerpack. NASA engineers performed an initial test of an Apollo-era powerpack at Stennis in 2008. For more information about NASA exploration, visit <http://www.nasa.gov/exploration>.

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Marshall Turns Over Five American Flags to American Legion Post 237 for Retirement

By Jessica Eagan



The Marshall Space Flight Center proudly displays the American flag -- a symbol of our country's strength and unity -- high above Building 4200.

Image left: From left, Philisha Stephens, property disposal officer, and Greg Tate, senior property disposal specialist, both of Marshall's Property Management Office in the Office of Center Operations, hand over five American flags that flew above Building 4200 to Ted Lott and Ranae Emmett of the American Legion Post 237 on June 7 for proper retirement. The flags will be honored and burned during the Flag Day ceremony on June 14 at the post. (NASA/MSFC/Emmett Given)

According to the [Flag Code](#), Title 4, Chapter 1, the flag represents a living country, and is itself considered a living thing. And when our icon has braved outdoor elements and is no longer a fitting emblem for display, the code dictates the flag should be destroyed in a dignified manner.

Five flags that waved atop 4200 were donated by the Marshall Center on June 7 to the Huntsville Madison County American Legion Post 273 for retirement.

The [American Legion](#) -- headquartered in Indianapolis, Ind. -- was chartered in 1919 by Congress as a veterans' nonprofit organization to advocate patriotism and honor, promote strong national security, mentor youth, sponsor wholesome programs in communities, and support fellow service members and veterans. Today, 14,000 posts exist worldwide with 2.4 million members. The posts are divided into 55 departments, which include one for the 50 states, along with the District of Columbia, Puerto Rico, France, Mexico and the Philippines.

"Many American Legion posts, including the one in Huntsville, hold a ceremony every June 14 on Flag Day to honor unserviceable flags and destroy them by burning, as suggested by the Flag Code," said Philisha Stephens, Marshall's property disposal officer in the Property Management Office in the Office of Center Operations. "Marshall turns over flags every year out of respect for our country."

Flag Day, which commemorates the adoption of the U.S. flag, was proclaimed by President Woodrow Wilson in 1916. In 1949, Congress officially declared June 14 to be National Flag Day.

To read more about flag rules and regulations, visit [here](#). To read more about the American Legion and membership, visit [here](#).

Eagan, an AI Signal Research Inc. employee and the Marshall Star editor, supports the Office of Strategic Analysis & Communications.

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Center for Internal Mobile Applications to Host Mobile Roadshow June 20 at Marshall

Want to learn more about NASA internal mobile applications? Team members from the Center for Internal Mobile Applications, located at the NASA Enterprise Applications Competency Center at the Marshall Space Flight Center, will host a mobile roadshow June 20. Visit the lobby of Building 4200 from 8:30-10:30 a.m. and 1:30-3:30 p.m., and the 4203 lobby from 11 a.m.-1 p.m. to learn about how the Center for Internal Mobile Applications is redefining business applications for NASA.

To learn more about this center and to download current mobile applications, visit [here](#).

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Giant Black Hole Kicked Out of Home Galaxy

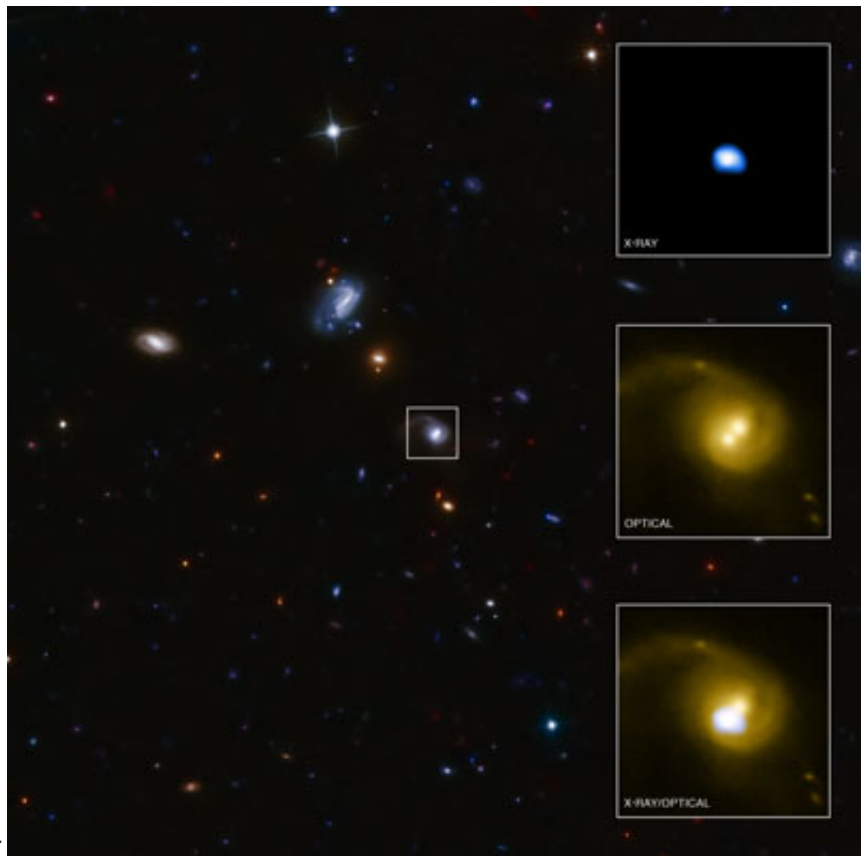
NASA news release

Astronomers have found strong evidence that a massive black hole is being ejected from its host galaxy at a speed of several million miles per hour. New observations from the Marshall Space Flight Center-managed Chandra X-ray Observatory suggest that the black hole collided and merged with another black hole and received a powerful recoil kick from gravitational wave radiation.

Image right: System CID-42, located about four billion light years away (X-ray: NASA/CXC/SAO/F.Civano et al; Optical: NASA/STScI; Optical (wide field): CFHT, NASA/STScI)

"It's hard to believe that a supermassive black hole weighing millions of times the mass of the sun could be moved at all, let alone kicked out of a galaxy at enormous speed," said Francesca Civano of the Harvard-Smithsonian Center for Astrophysics, who led the new study.

"But these new data support the idea that gravitational waves -- ripples in the fabric of space first predicted by Albert Einstein but never detected directly -- can exert an extremely powerful force."



Ejection of a supermassive black hole from a galaxy by recoil because more gravitational waves are being emitted in one direction than another is likely to be rare. But it nevertheless could mean that there are many giant black holes roaming undetected out in the vast spaces between galaxies.

"These black holes would be invisible to us," said co-author Laura Blecha, also of the Harvard-Smithsonian Center for Astrophysics, "because they have consumed all of the gas surrounding them after being thrown out of their home galaxy."

Civano and her group have been studying a system known as CID-42, located in the middle of a galaxy about four billion light years away. They had previously spotted two distinct, compact sources of optical light in CID-42, using NASA's Hubble Space Telescope.

More optical data from the ground-based Magellan and Very Large Telescopes in Chile supplied a spectrum (that is, the distribution of optical light with energy) that suggested the two sources in CID-42 are moving apart at a speed of at least 3 million miles per hour.

Previous Chandra observations detected a bright X-ray source likely caused by super-heated material around one or more supermassive black holes. However, they could not distinguish whether the X-rays came from one or both of the optical sources because Chandra was not pointed directly at CID-42, giving an X-ray source that was less sharp than usual.

"The previous data told us that there was something special going on, but we couldn't tell if there were two black holes or just one," said another co-author Martin Elvis, also of the Harvard-Smithsonian Center for Astrophysics. "We needed new X-ray data to separate the sources."

When Chandra's sharp High Resolution Camera was pointed directly at CID-42, the resulting data showed that X-rays were coming only from one of the sources. The team thinks that when two galaxies collided, the supermassive black holes in the center of each galaxy also collided. The two black holes then merged to form a single black hole that recoiled from gravitational waves produced by the collision, which gave the newly merged black hole a sufficiently large kick for it to eventually escape from the galaxy.

The other optical source is thought to be the bright star cluster that was left behind. This picture is consistent with recent computer simulations of merging black holes, which show that merged black holes can receive powerful kicks from the emission of gravitational waves.

There are two other possible explanations for what is happening in CID-42. One would involve an encounter between three supermassive black holes, resulting in the lightest one being ejected. Another idea is that CID-42 contains two supermassive black holes spiraling toward one another, rather than one moving quickly away.

Both of these alternate explanations would require at least one of the supermassive black holes to be very obscured, since only one bright X-ray source is observed. Thus the Chandra data support the idea of a black hole recoiling because of gravitational waves.

These results appeared in the June 10 issue of The Astrophysical Journal.

For Chandra images, multimedia and related materials, visit <http://www.nasa.gov/chandra>.

For an additional interactive image, podcast, and video on the finding, visit <http://chandra.si.edu>.

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Marshall Space Flight Center engineer Howard Soohoo, right, and electronics technician Chris Conn, partially hidden, both supporting Marshall's Engineering Directorate, show how to freeze objects with liquid nitrogen -- and explain the science behind it -- to children and their parents during Marshall's annual "Take Our Children to Work Day" on June 7. This "cool" demonstration at Activities Building 4316 was part of the annual event in which Marshall civil service and contractor employees' children in grades 3-12 participate in a host of hands-on activities and workshops tied to a variety of work conducted at the center. (NASA/MSFC/Emmett Given)

Allison Young, center in pink shirt, a Wyle Corp. employee supporting Marshall's Space Launch System Program Office, helps an excited youngster take a souvenir astronaut photo at one of the NASA photo kiosks during "Take Our Children to Work Day." The event, which drew more than 500 children, is organized by Marshall's Office of Diversity & Equal Opportunity. (NASA/MSFC/Emmett Given)



Eight-year-old Jackson Moore gets a few goodies to take home from a Redstone Arsenal fireman. The arsenal fire department also had one of its ladder trucks on display for the kids to check out during "Take Our Children to Work Day." Looking over Jackson's shoulder is his grandfather, David Guy, a safety and occupational health specialist supporting Marshall's Safety & Quality Department. (NASA/MSFC/Emmett Given)

And they're off! Two girls launch their balloon rockets, one of more than 25 "Take Our Children to Work Day" activities. Some of the other events included a viewing of the animated film, "Rio," complete with popcorn; a rain barrel presentation to teach about the water cycling and water conservation processes; a straw rocket launch; and a tour of Marshall's Mobile Command Center. The 40-foot-long mobile command operations center is designed to respond to emergencies and operate independently for extended periods of time. (NASA/MSFC/Emmett Given)



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Marshall Association 2012 Scholarship Application Season is Now Open; Scramble 'Fore' Scholarships with Tee Time

The Marshall Association is accepting applications for its 2012 scholarships.

The association plans to grant two scholarships: a \$500 minimum scholarship for a student pursuing a bachelor's degree in a Science, Technology, Engineering and Mathematics, or STEM, field of study, and a \$500 minimum scholarship for a student pursuing a bachelor's degree in a non-STEM field of study.

Eligible applicants must be the dependent of a 2012 Marshall Association member -- current or retired civil service, or contractor members that have joined the association prior to June 28. In addition, all applicants must be entering their freshman year of college this fall.

Completed applications should be submitted to Sherry White by 4 p.m. CDT on June 29. No late applications will be accepted. The scholarship application form can be accessed [here](#).

Association Hosts Golf Scramble

To support the Marshall Association scholarships, the club is hosting a Golf Scramble on June 29 at Sunset Landing Golf Course, 346 James Record Road, Huntsville. Lunch begins at 11 a.m., and tee time will start promptly at 12:30 p.m. Early registration, which ends June 22, is \$50 for association members and \$55 for nonmembers. Late registration is \$60 for members and \$65 for nonmembers, and ends June 29. To register, visit [here](#). For questions, contact Amir Deylami at amir.deylami@nasa.gov or at 256-961-1646. For more information, visit [here](#).

For more information about the Marshall Association, team members can visit [here](#).

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Obituaries

Lorene "Sissy" Birdwell, 79, of Guntersville died May 10. She retired from the Marshall Center in 1990 as a program analyst.

J.R. Blankenship, 90, of Huntsville died May 24. He retired from the Marshall Center in 1972 as an electronic technician. He is survived by his wife, Ethel Nolene Blankenship.

Travis Oneal Fullwood, 87, of Selmer, Tenn., died May 24. He retired from the Marshall Center in 1987 as an aerospace engineer.

Vivian Murphy Bell, 90, of Madison died May 25. She retired from the Marshall Center in 1987 as a computer systems analyst.

Lee "Sam" Welch, 84, of Huntsville died May 31. He retired from the Marshall Center in 1988 as a facility management specialist.

Find this article at:

<http://www.nasa.gov/centers/marshall/about/star/index.html>